# CLAIMS

1.     1.     A method for extracting data of interest from observed vector data, the method
2. comprising:
3.     determining the projection of each vector in observed vector data onto a subspace as a
4. vector subtraction in an original coordinate system.

1.     2.     A method for processing a block of discrete data vectors to obtain a decomposition of the
2. data with respect to a correlation direction vector, the method comprising:
3.     multiplying each data vector onto the correlation direction vector to determine a scalar
4. amplitude of each data vector in the direction of the correlation direction vector;
5.     multiplying each scalar amplitude onto the correlation direction vector to determine a set
6. of scaled vectors; and
7.     subtracting the scaled vectors from the data vectors.

1.     3.     In a filter, a method for processing a block of discrete data vectors to obtain a
2. decomposition of the data with respect to a correlation direction vector, the method comprising:
3.     multiplying each data vector onto the correlation direction vector to determine a scalar
4. amplitude of each data vector in the direction of the correlation direction vector;
5.     multiplying each scalar amplitude onto the correlation direction vector to determine a set
6. of scaled vectors; and
7.     subtracting the scaled vectors from the data vectors.

1.     4.     A method for adaptively analyzing data, the data characterized by a set of data vectors, to
2. estimate that part of the data that best corresponds to a steering vector, the method comprising:
3.     in a first analysis stage:
4.     projecting each data vector onto the steering vector to form a set of inner products
5.     that estimate the part of the data that best corresponds to the steering vector,
6.     multiplying the inner products onto the steering vector to form a set of vector
7.     estimates of that part of the data that best corresponds to the steering vector,
8.     subtracting the vector estimates from the corresponding data vectors to obtain a
9.     projection of the data onto the nullspace of the steering vector; and

10 in at least one adaptive analysis stage:

11  calculating a correlation direction vector of the current adaptive stage between the

12   corresponding inner products and vector differences of an immediately prior

13   analysis stage;

14  forming inner products of the current stage by projecting each vector difference of

15   the immediately prior analysis stage onto the correlation direction vector of the

16   current stage;

17  forming scaled vectors of the current stage by multiplying the inner products of the

18   current stage onto the correlation direction vector of the current stage;

19  forming the projection of the prior stage vector differences onto the nullspace of the

20   correlation direction vector of the current stage by subtracting each scaled

21   vector of the current stage from the corresponding projection of the prior stage.

1 5. A method for adaptively analyzing an observed signal, the signal characterized by a set of

2 data vectors, to estimate that part of the signal that best corresponds to a steering vector, the

3 method comprising:

4  in a first analysis stage:

5  projecting each data vector onto the steering vector to form a set of inner products

6   that estimate the part of the data that best corresponds to the steering vector,

7  multiplying the inner products onto the steering vector to form a set of vector

8   estimates of that part of the data that best corresponds to the steering vector,

9  subtracting the vector estimates from the corresponding data vectors to obtain a

10   projection of the data onto the nullspace of the steering vector; and

11 in at least one adaptive analysis stage:

12  calculating a correlation direction vector of the current adaptive stage between the

13   corresponding inner products and vector differences of an immediately prior

14   analysis stage;

15  forming inner products of the current stage by projecting each vector difference of

16   the immediately prior analysis stage onto the correlation direction vector of the

17   current stage;

18  forming scaled vectors of the current stage by multiplying the inner products of the

19   current stage onto the correlation direction vector of the current stage;

20  forming the projection of the prior stage vector differences onto the nullspace of the

21  correlation direction vector of the current stage by subtracting each scaled

22  vector of the current stage from the corresponding projection of the prior stage.

23  6.  A method for adaptively analyzing discrete data, the data characterized by a vector data

24  set and a scalar data set, the sets having a common index, to obtain a decomposition of the data

25  based on correlation between the sets, the method comprising

26  in a first stage:

27  forming a first stage correlation direction vector between corresponding elements of

28  the vector data set and the scalar data set;

29  forming a set of first stage inner products between the vector data set and the first

30  stage correlation direction vector;

31  forming a set of first stage scaled direction vectors between the scalar data set and

32  the first stage correlation direction vector;

33  forming a set of first stage vector differences between the corresponding elements of

34  the set of first stage scaled direction vectors and the vector data set; and

35  in each of zero or more subsequent stages:

36  receiving the set of inner products and the set of vector differences of the

37  immediately prior stage as inputs to the current stage;

38  forming a current stage correlation direction vector between corresponding elements

39  of the sets of inner product and vector difference current stage inputs;

40  forming a set of current stage inner products between the set of current stage vector

41  difference inputs and the current stage correlation direction vector;

42  forming a set of current stage scaled direction vectors between the set of inner

43  product current stage inputs and the current stage correlation direction vector;

44  forming a set of current stage vector differences between the corresponding elements

45  of the set of current stage scaled direction vectors and the set of current stage

46  vector difference inputs.

1  7.  An analysis chain for a multistage adaptive filter, the analysis chain comprising:

2  a non-adaptive analysis stage, comprising:

3  a first inner product logic device operative:

4  to receive a set of data vectors and a steering vector, and

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5            to form a first set of inner products of the steering vector and each data vector,

6                  and

7        a first vector scaling logic device:

8            in communication with the first inner product logic device, and

9            operative:

10              to receive the steering vector and the first set of inner products, and

11              to form a first set of scaled direction vectors of the steering vector and

12                 each inner product of the first set of inner products, and

13        a first vector difference logic device:

14            in communication with the first vector scaling logic device, and

15            operative:

16              to receive the set of data vectors and the first set of scaled vectors, and

17              to form a first set of vector differences between corresponding elements of

18                 the set of data vectors and the first set of scaled vectors; and

19    at least one adaptive analysis stage comprising:

20        a correlation direction vector logic device:

21            in communication with the immediately prior stage, and

22            operative:

23              to receive a set of vector differences of the immediately prior stage and a

24                 set of inner products of the immediately prior stage, and

25              to form a current stage correlation direction vector between the vector

26                 differences of the immediately prior stage and the corresponding

27                 inner products of the immediately prior stage; and

28        an adaptive stage inner product logic device:

29            in communication with the immediately prior stage and the adaptive stage

30              correlation direction vector logic device of the current stage, and

31            operative:

32              to receive the set of vector differences of the immediately prior stage and

33                 the current stage correlation direction vector, and

34              to form a current stage set of inner products of each vector difference of

35                 the immediately prior stage and the current stage correlation direction

36                 vector; and

37        an adaptive stage vector scaling logic device:

38      in communication with the correlation direction vector logic device of the

39            current stage and the inner product device of the current stage, and

40      operative:

41            to receive the set of inner products of the current stage and the correlation

42                  direction vector of the current stage, and

43            to form a current stage set of scaled direction vectors of each inner product

44                  of the set of inner products of the current stage and the correlation

45                  direction vector of the current stage; and

46      an adaptive stage vector difference logic device:

47            in communication with the vector difference logic device of the immediately

48                  prior stage and the vector scaling logic device of the current stage, and

49            operative:

50                  to receive the set of vector differences of the immediately prior stage and

51                        the set of scaled vectors of the current stage, and

52                  to form a current stage set of vector differences between corresponding

53                        elements of the set of vector differences of the immediately prior

54                        stage and the set of scaled direction vectors of the current stage.

1      8.      A method for adaptively analyzing an observed signal, the signal characterized by

2      discrete data, the data characterized by a vector data set and a scalar data set, the sets having a

3      common index, to obtain a decomposition of the data based on correlation between the sets, the

4      method comprising

5            in a first stage:

6                  forming a first stage correlation direction vector between corresponding elements of

7                        the vector data set and the scalar data set;

8                  forming a set of first stage inner products between the vector data set and the first

9                        stage correlation direction vector;

10                  forming a set of first stage scaled direction vectors between the scalar data set and

11                        the first stage correlation direction vector;

12                  forming a set of first stage vector differences between the corresponding elements of

13                        the set of first stage scaled direction vectors and the vector data set; and

14            in each of zero or more subsequent stages:

15                  receiving the set of inner products and the set of vector differences of the

16                        immediately prior stage as inputs to the current stage;

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17    forming a current stage correlation direction vector between corresponding elements

18        of the sets of inner product and vector difference current stage inputs;

19    forming a set of current stage inner products between the set of current stage vector

20        difference inputs and the current stage correlation direction vector;

21    forming a set of current stage scaled direction vectors between the set of inner

22        product current stage inputs and the current stage correlation direction vector;

23    forming a set of current stage vector differences between the corresponding elements

24        of the set of current stage scaled direction vectors and the set of current stage

25        vector difference inputs.

1    9.    An adaptive stage of an analysis chain for a multistage adaptive filter, the adaptive stage

2    comprising:

3        a correlation direction vector logic device:

4            in communication with the immediately prior stage, and

5            operative:

6                to receive a set of vector differences of the immediately prior stage and a

7                    set of inner products of the immediately prior stage, and

8                to form a current stage correlation direction vector between the vector

9                    differences of the immediately prior stage and the corresponding

10                    inner products of the immediately prior stage; and

11        an adaptive stage inner product logic device:

12            in communication with the immediately prior stage and the adaptive stage

13                correlation direction vector logic device of the current stage, and

14            operative:

15                to receive the set of vector differences of the immediately prior stage and

16                    the current stage correlation direction vector, and

17                to form a current stage set of inner products of each vector difference of

18                    the immediately prior stage and the current stage correlation direction

19                    vector; and

20        an adaptive stage vector scaling logic device:

21            in communication with the correlation direction vector logic device of the

22                current stage and the inner product device of the current stage, and

23            operative:

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24               to receive the set of inner products of the current stage and the correlation

25                     direction vector of the current stage, and

26               to form a current stage set of scaled direction vectors of each inner product

27                     of the set of inner products of the current stage and the correlation

28                     direction vector of the current stage; and

29     an adaptive stage vector difference logic device:

30     in communication with the vector difference logic device of the immediately prior

31          stage and the vector scaling logic device of the current stage, and

32          operative:

33               to receive the set of vector differences of the immediately prior stage and

34                     the set of scaled vectors of the current stage, and

35               to form a current stage set of vector differences between corresponding

36                     elements of the set of vector differences of the immediately prior

37                     stage and the set of scaled direction vectors of the current stage.

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